Fall 2021 - Introduction to Remote Sensing - GEOM3002

Department of Geography and Environmental Studies

Instructor: Koreen Millard koreenmillard@cunet.carleton.ca
Office hours: Wednesdays 13:30 - 14:30 (on zoom)

Lecture Time: Thursdays 12:35 - 14:25 (on zoom)

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Office Hours: TBD

Labs:
A2: Mondays 11:35 - 13:25
A3: Wednesdays 11:35 - 13:25

Textbook: Remote Sensing, A. Knudby (2021) online (free and open access):
https://ecampusontario.pressbooks.pub/remotesensing/

Course Description:

Principles and methods of remote sensing; visual interpretation of air photos and satellite imagery; digital image processing, analysis and classification for thematic mapping; introduction to various active and passive remote sensing imagery types such as optical, hyperspectral, RADAR and LiDAR. We will use a variety of software in the course. Google Earth Engine is an online free cloud processing software. Other software (QGIS, SNAP, Pix4D are all available in our lab through Virtual Machine access). You will require familiarity with the Windows operating system. A Virtual Machine is available through the department so Mac and Linux users can access a Windows environment. It is also assumed that students will be able to use word processors and other utilities (Acrobat Reader, Winzip/7Zip, Notepad, Explorer etc). No coding skills are required, but students should be ready to learn how to use and develop some basic scripts in the labs.

This course will run online using a blended approach. Lectures will be given live on zoom during lecture time slot - these will also be recorded and posted on Brightspace. You can log in and join the lectures live and ask questions, or watch the recorded lectures on your own schedule. Technical guidance and my office hours will also be online. The aim is to use this time for you to get extra help if needed. Office hours and technical help sessions will not be recorded. There will be components of the group project where you need to be online during the lecture or lab periods. Quizzes will correspond with the lecture material but will not have a scheduled time period.

Labs will be demonstrated by the Teaching Assistant through pre-recorded videos, uploaded in advance of the lab time slots. The lab timeslots will be informal and allow you to ask questions and get technical help.

II. Preclusions: GEOG3002 (no longer offered)

III. Learning Outcomes:

- Understand the conceptual and technical background related to image formation and spectral reflectance theory, types of remote sensors currently in use

- Use theoretical understanding to determine the appropriate sensor to observe specific geographic phenomenon

- Perform visual interpretation of images, image enhancement, thematic mapping using remotely sensed imagery

- Use theoretical understanding to determine the best workflow for processing and analyzing remotely sensed imagery

 V. Evaluation:

- 5 labs (variable weighting) = 40%
- mid term @ 25%
- 6 quizzes @ 3% each (drop lowest quiz grade) = 15%
- final project @ 20%

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Late Policy: All assignments must be submitted through the Brightspace dropbox by the due date and time. No late assignments will be accepted, with the exception of those cases where a student is sick or if you have already arranged for academic accommodation as described in subsequent sections of this syllabus. In the case of illness, you must make arrangements with the course instructor prior to the due date/time. In place of a doctor's note or medical certificate, students are advised to complete the self-declaration form available on the Registrar's Office website to request academic accommodation for missed coursework including exams and assignments.

Lecture/Lab attendance: Lectures will cover theoretical components of remote sensing and may also include software demonstrations. Lectures will be recorded and available through Brightspace. Labs will include software demonstrations and one-on-one help will be available for software and practical related questions. Virtual attendance will be required to some group project meetings to facilitate group discussion and collaboration. The dates and times of these meetings can be scheduled by the group members, but should conform to the general requirements of the project.

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VI. Course calendar (**tentative: dates and topics subject to change**):

Lecture date	lecture topic	Lab Topic	A2 Lab (Monday)	A3 Lab (Wednesday)
Week 1 9-Sep	Welcome; Intro to the course; what is remote sensing? what can it be used for? brief history of remote sensing	No Labs	No Labs	No Labs
Week 2 16-Sep	introduction to the electromagnetic spectrum and black body radiators; radiation and target interactions; atmospheric windows	Lab 1: Part 1: Explore a GEE App	Sep 13	Sept 15
Week 3 23-Sep	introduction to remote sensing data; raster images, types of resolution, pixel types, bit depth, review of projections and coordinate systems	Lab 1: part 2: Downloading imagery and working with imagery locally in QGIS	Sept 20	Sept 22
Week 4 30-Sep	Passive Optical Remote Sensing - common sensors, uses, orbit types	Lab 1: part 3 working with imagery in Google Earth Engine and Google Co-lab	Sept 27	Sept 29
Week 5 7-Oct	Passive Optical Remote Sensing 2 - what is an "image", images as radiometric measurements, types of imaging, image enhancement, atmospheric and radiometric correction, orthorectification.	Lab 2: part 1: explore different processing levels and image enhancements in GEE/Colab	Oct 4	Oct 6
Week 6 14-Oct	Passive Optical 3 - image interpretation, indices, texture, cloud masks, composites, mosaics		No Lab	No Lab
Week 7 21-Oct	Active Remote Sensing - SAR1 (basics of SAR and SAR sensors, data collection)	Lab 2: part 2: explore cloud masking, compositing and mosaicking in GEE/Colab	Oct 18	Oct 20
28-Oct	Fall Break		No Lab	No Lab
Week 8 4-Nov	Active Remote Sensing - SAR2 - speckle filtering, polarizations and polarimetry	Lab 3 Part 1: Working with Sentinel-1 in GEE/Colab	Nov 1	Nov 3

Week 9 11-Nov	Active Remote sensing - SAR 3 - InSAR, coherent change detection	Lab 3 Part 2: processing Sentinel-1 imagery in SNAP	Nov 8	Nov 10
Week 10 18-Nov	Passive Microwave Remote Sensing - including common sensors, products, uses	Lab 3 Part 2: processing Sentinel-1 imagery in SNAP	Nov 15	Nov 17
Week 11 25-Nov	UAVs and Structure from Motion	Lab 4: working with SMAP	Nov 22	Nov 24
Week 12 2-Dec	Active Remote Sensing- LiDAR	Lab 4: working with SMAP	Nov 29	Dec 1
Week 13 9-Dec	Present Final Projects	Lab 5: Working with Point Clouds	Dec 6	Dec 8

VII. Statement on Plagiarism
 PLAGIARISM

The University Senate defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This can include:

• reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source;

• submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;

• using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;

• using another's data or research findings;

• failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

 VIII. Requests for Academic Accommodations

Please include the following text, provided by Equity Services, on all course outlines, and read it at the beginning of your first few classes to remind students. For details, see the Instructors'

Academic Accommodation
You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/equity/sexual-assault-support-services

Accommodation for Student Activities
Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the *national or international level.* Write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.
https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf